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ABSTRACT

Developed as part of the ABCs of Construction National Workplace Literacy Project, this instructional module consists of instructional materials and application problems designed to help persons employed as millwrights learn to measure decimals. The six exercises included in the module each consist of series of problems in which students are required to measure, read, add, and subtract decimals and use the "OPEN" (Operation, Pick, Execute, Note) approach to working with decimals. (MN)

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MODULES OF INSTRUCTION DEVELOPED IN GRANT CYCLE

1. Writing Frames for Construction Workers (10 exercises)

for low-level readers; consists of 10 "paragraphs" with open-ended sentences for workers to complete and recopy in their notebooks. Topics deal with work and training, such as "My Job," "Classroom Behavior," and "Listening to Myself."

2. Writing About Your Craft (10 topics)

for all students; list of 10 topics, such as "My Boss," "The Main Beef About My Job," and "How Work Orders Are Delivered." Used for integrating reading and writing in a job-specific context.

3. Building Workplace Vocabulary for E & I: Structural Analysis (80 pages)
Building Workplace Vocabulary for Millwrights: Structural Analysis(79 pages)
Building Workplace Vocabulary for Pipefitters: Structural Analysis(79 pages)

5th grade level; teaches word attack skills for technical terms, utilizing word parts and root words; includes hints for retaining meanings by building card file with visual representations of terminology.

4. Building Workplace Vocabulary for E & I: General, Specialized, & Technical Terms (58 pages)
Building Workplace Vocabulary for Millwrights: General, Specialized & Technical Terms (29 pages)
Building Workplace Vocabulary for Pipefitters: General, Specialized, & Technical Terms (32 pages)

5th grade level; teaches different kinds of vocabulary words encountered in work-related texts; drills for remembering new words; tips for building vocabulary; some dictionary use.

5. Building Workplace Vocabulary for E & I: Compound Words (28 pages)
Building Workplace Vocabulary for Pipefitters: Compound Words (18 pages)
Building Workplace Vocabulary for Millwrights: Compound Words (22 pages)

5th grade level; strategies for finding the meanings of compound words used in technical writing; works with words in context

6. Improving Listening Skills: Hazards Communication (18 pages)
Improving Listening Skills: Fire Extinguishers (22 pages)

a viewing, study guide that accompanies a commercial training video used in the required 8-hour OSHA safety course; learning new words, main ideas, and drawing conclusions are covered.

7. Measuring Decimals: Millwright (28 pages)

instruction and application problems

8. Improving Study Skills/Test Taking (60 pages)

6th grade level; good study skills are needed for success in the ABC Training program; explores strategies for organizing class notes and study time; analysis sheet for determining weaknesses in test preparation; how to schedule to arrange study time and work time

Computer Program

"Math for Pipefitters" is an interactive, multi-media program that covers fractions, decimals, angles, and right triangle geometry in a pipefitting context (88 screens)

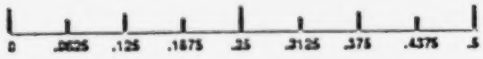
Measuring Decimals
Exercise 1 for Millwrights

Millwrights need to know how to read and work with decimals in their work. To help you refresh your memory of decimals, use the "Construction Inch," a big model of an inch, to help you see and feel the difference between the decimals used in the following problems.

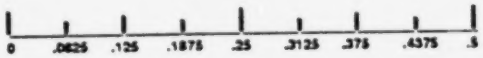
1. Find blocks of wood that are marked: 0.5, 0.25, 0.125, and 0.0625.

   a. Which block is the biggest?

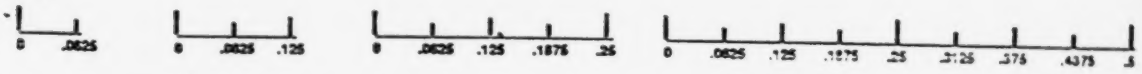
   b. Which block is the smallest?

   c. Is 0.5 bigger or smaller than 0.25?

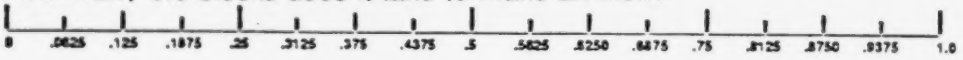
   

   d. Put these blocks in order with the smallest to the left and the biggest to the right. What order would this be?

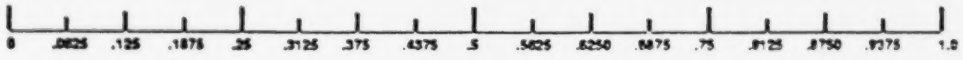
   

2. Use the wood blocks to make an inch.

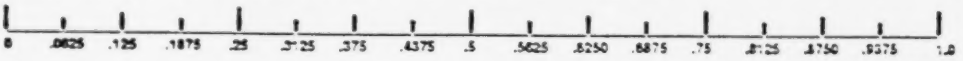
   a. How many 0.5 blocks does it take to make an inch?

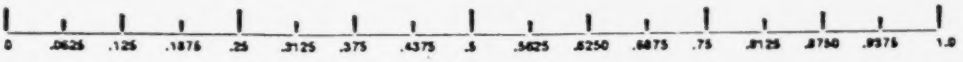
   b. How many 0.25 blocks does it take to make an inch?

   c. How many 0.125 blocks does it take to make an inch?

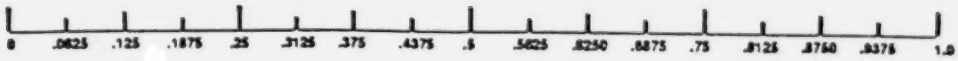
   

   d. How many 0.0625 blocks does it take to make an inch?

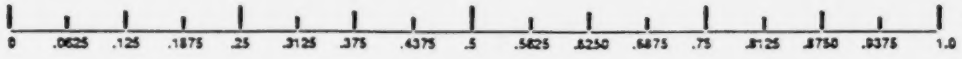
   

3. Place the wood blocks in the "Construction Inch" or directly behind it to help see the answers to the following questions.

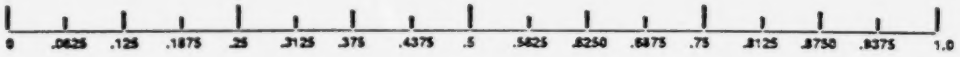
   a. Add 0.125 + 0.125 + 0.125.



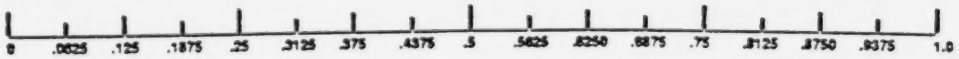
   Is this bigger or smaller than 0.25 + 0.25 + 0.25?



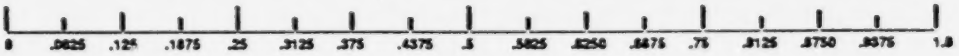
   b. Which is smaller, 0.3125 or 0.625?



   c. Which is bigger, 0.25 or 0.375?

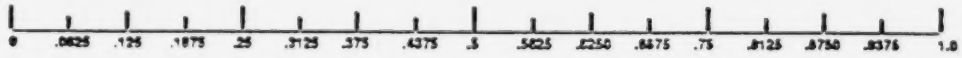


   d. Add 0.125 + 0.125. Is this bigger, smaller or the same size as 0.25?

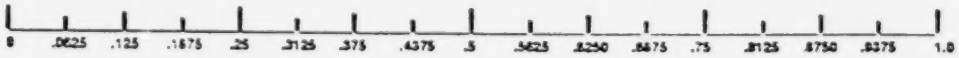


4. Compare the blocks' sizes of 0.5, 0.25, 0.125 and 0.0625.

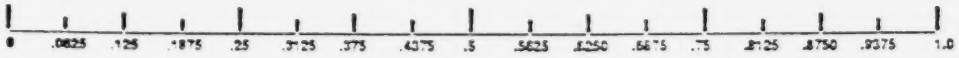
   a. How many 0.0625's are equal to 0.125?



   b. How many 0.0625's are equal to 0.25?

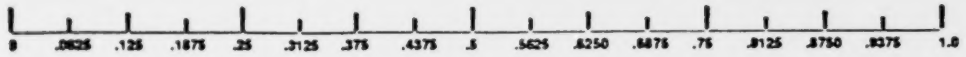


   c. How many 0.0625's are equal to 0.5?

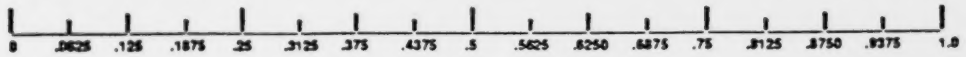


5. Using the "Construction Inch" model, how many 0.125's are equal to these decimals?

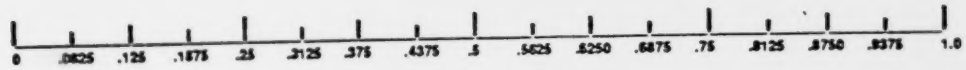
   a. The decimal 0.5?



   b. The decimal 0.75?

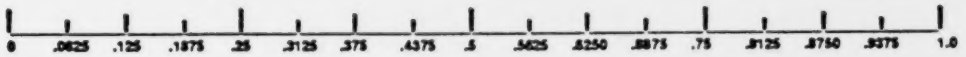


   c. The decimal 0.25?

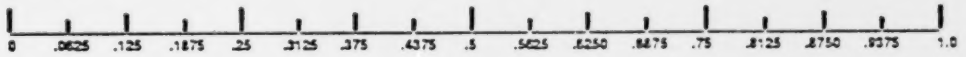


6. Which is bigger or equal in each of the following problems? (Use the "Construction Inch" to compare the two measurements.)

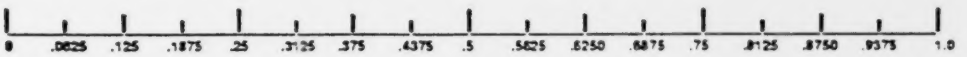
   a. 0.125 + 0.125 + 0.125 or 0.25?



   b. 0.125 + 0.25 or 0.5?

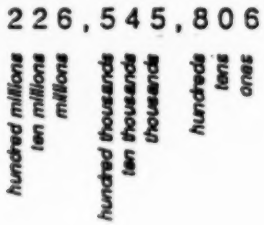


   c. 0.25 + 0.0625 + 0.0625 or 0.5?



Reading Decimals
Exercise 2 for Millwrights

It is important to read a number correctly. Each location in a number has a **place value.** Here are the place values for nine digits of the number that represents the U.S. population:



When a number represents a value that is less than 1, it can be written as a decimal. A **decimal point** (looks like a period) separates whole numbers to the *left* of the **decimal point** from the **decimal fractions** to the *right* of it. Any number to the *right* of the decimal point is *smaller* than "1". When there are numerals to the right of the decimal point, these numerals indicate only a part of "one" is to be considered.

Example 1: .5 = the fraction 5/10 (5 parts in 10)
Example 2: .25 = the fraction 25/100 (25 parts in 100)

Note: Sometimes it is helpful to think of decimals as you would money. The following figures contain decimal fractions: $.50, $.75, and $1.25. As you know, the period separates the dollars from the change. The decimal .5 can be thought of as $.50 because it means 5 parts in 10 or as in money, 5 dimes in a dollar. The .75 can be thought of as $.75 because it has 75 parts in a dollar or as in money, 3 quarters in a dollar. The .25 can be thought of as a quarter, $.25.

The names of the places to the right of the **decimal point** are similar to the names of the places to the left. Think of the ones place and the **decimal point** as the center.

1,234,567.654321 (the .654321 is less than 1)

Using the examples below, read the first example (.5) then cover up everything to the right of it and ask yourself these questions for each of the examples:

1) How many places does this example have that are to the right of the decimal point?
2) What is the "decimal fraction" name of this example?
3) How would you write this decimal as a fraction?
4) How would you write this decimal?

Examples	Places	Decimal Names		Fraction	Written
.5	1 place =	tenths	=	5/10	five tenths
.25	2 places=	hundredths	=	25/100	twenty-five hundredths
.075	3 places=	thousands	=	75/1,000	seventy-five thousandths
.0025	4 places=	ten thousandths	=	25/10,000	twenty-five ten thousandths
.00125	5 places=	hundred thousandths	=	125/100,000	one hundred twenty-five hundred thousandths
.000375	6 places=	millionths	=	375/1,000,000	three hundred seventy-five millionths

Reading Decimals

Remember that any number to the *left* of the decimal point is read as a whole number. Any number to the *right* of the decimal point will tell the decimal fraction. When you read a decimal, ***always*** say the word "***and***" where the decimal point is located.

Examples: Read .0075

Step 1 Read the number: seventy-five

Step 2 Count the number of spaces to the right of the decimal point. .0075 has four spaces. Four places means ten thousandths.

Step 3 Read .0075 as seventy-five ten thousandths.

Read 2.625

Step 1	Read the whole number: two
Step 2	Read the decimal fraction number: six hundred twenty-five
Step 3	Count the number of spaces to the right of the decimal point. 2.625 has three spaces which means thousandths.
Step 4	Read 2.625 as two <u>and</u> six hundred twenty-five thousandths.

Practice # 1 Match the numbers with the correct way to say them:

1. 40.5
   a. four and five tenths
   b. four hundred five
   c. forty and five tenths
   d. None of the above

2. 2,004.25
   a. Two thousand and four twenty-five hundredths
   b. Two thousand four and twenty-five hundredths
   c. Two hundred thousand four hundred twenty-five
   d. None of the above

3. 3.8125
   a. Thirty thousand eighty-one hundred twenty-five
   b. Three and eight thousand one hundred twenty-five ten thousandths
   c. Three and eight thousand one hundred twenty-five thousandths
   d. None of the above

4. 73.75
   a. Seventy-three and seventy-five hundredths
   b. Seven thousand three hundred seventy-five
   c. Seventy-three and seven hundred five hundredths
   d. None of the above

5. 279.9375
   a. Two hundred seventy-nine and nine thousand three hundred seventy-five thousandths
   b. Two hundred seventy-nine and nine thousand three hundred seventy-five hundred thousandths
   c. Two hundred seventy-nine and nine thousand three hundred seventy-five ten thousandths
   d. None of the above

6. 1.625
   a. One and six hundred twenty-five
   b. One and six hundred twenty-five hundred thousandths
   c. One and six hundred twenty-five thousandths
   d. None of the above

Answers to Practice #1 (Reading Decimals, Ex. 2) find in last section of notebook

Practice # 2 Match the mixed numbers on the left side of the page with the correct way to read them on the right side.

1. 3.125	a. thirty-one and twenty-five hundredths
2. 0.3125	b. three thousand one hundred twenty-five millionths
3. 31.25	c. three hundred twelve and five tenths
4. 312.5	d. three thousand one hundred twenty-five ten thousandths
5. 0.003125	e. three and one hundred twenty-five thousandths

Practice # 3 Match some more mixed numbers on the left side of the page with the correct way to read them on the right side.

1. 43.75	a. four and three hundred seventy-five thousandths
2. 4.375	b. four thousand three hundred seventy-five hundred thousandths
3. 0.004375	c. four thousand three hundred seventy-five ten thousandths
4. 0.4375	d. forty-three and seventy-five hundredths
5. 0.04375	e. four thousand three hundred seventy-five millionths

Answers to Practice #2 and #3 (Reading Decimals, Ex. 2) find in last section of notebook

Adding Decimals
Exercise 3 for Millwrights

Addition of Decimals

In the addition problems below you will add mixed numbers that include decimals. The first six problems include decimals that are given to the hundredths of an inch (two places to the right of the decimal point). As you work these problems you may wish to think of them as similar to money problems.*

Always place the decimal points in a line.

example:

```
  7.75"
+8.25"
 16.00
```

NOT ~~7.75"~~ ~~+8.25"~~ ~~16.00~~

1. Add 5.25" + 1.50" or $ 5.25 + 1.50

2. Add 4.00" + 2.75" or $ 4.00 + 2.75

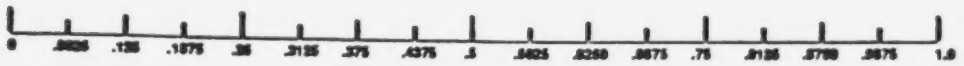
3. Add 10.75" + 1.25" or $ 10.75 + 1.25

4. Add 120.75" + 100.50 or $ 120.75 + 100.50

5. Add 100.25" + 64.50" or $ 100.25 + 64.50

* **Note:** If you'd like to use a calculator to work these problems, please do so.

These problems are to the thousandths of an inch (3 places to the right of the decimal point). Use the model inch if it will help you "see" the problem.



6. Add 2.125
+ 8.500

7. 12.125
+ 1.625

8. 16.750
+ 1.125

9. 72.375
+ 2.625

10. 24.875
+ 2.250

* **Note**: If you'd like to use a calculator to work these problems, please do so.

"OPEN" Approach to Decimals
Exercise 4 for Millwrights

A millwright needs to know how to work with decimals. It is important to remember how to think through a problem to find the answer. Here is **"OPEN"**, a 4 step procedure designed to help you find the right answer to math problems you have on the job:

Step 1 **"O" Operation** - Select which operation is needed to find the answer (*addition, subtraction, multiplication, or division*).

Step 2 **"P" Pick** - Pick the numbers to work the operation.

Step 3 **"E" Execute** - Work the problem and find the answer.

Step 4 **"N" Note** - Does the answer seem correct?

Let's work a problem using the **"OPEN"** method:

Bill's supervisor wants to know how long two PVC pipes are before they are threaded together. The first pipe is 6.25" and the second pipe is 5.5".

To do this problem Bill would think through it using the "OPEN" steps listed above:

Step 1 **Operation:** Addition. Add the lengths of the 2 pipes

Step 2 **Pick:** The numbers are 6.25" and 5.50"

Step 3 **Execute:**

$$\begin{array}{r} 6.25" \\ +\ 5.50" \\ \hline 11.75" \end{array}$$

Step 4 **Note:** Does this answer seem correct? Yes

Practice # 1 ("OPEN" Ex. 4) Try the following word problems:

1. Jerry cut a 2" pipe 8.375" long. He showed it to his supervisor who was pleased with Jerry's work. He then asked Jerry to cut a piece that was 2.375" longer than the first pipe. How long would the new pipe be?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

2. Ned likes his new job. One of his first assignments is to cut 2 pieces of 2" pipe. He needs one piece to be 14.625" and the other to be 9.875". He locates a 2" pipe that is 24" long. Can he get both pieces out of it?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

3. An engineer at Jacob's Engineering determined a barge with crude oil could be unloaded ten hours faster if the 32.5" unloading pipe was replaced with a 3.125" wider pipe. You're told to go get the new pipe. What diameter should the new pipe be?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

4. Betsy is told the 22.4375" pipe she cut is 0.6875" too short for the next fitting. How long should she cut the next fitting?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

5. George and Fred were first told to cut a PVC pipe 62.375" long. Just as they were ready to cut it, their supervisor said to make it 8.250" longer. How long should they cut the pipe?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

Adding More Decimals
Exercise 5 for Millwrights

If you'd like more practice with adding decimals, use the 4 steps in "OPEN" on the problems below:

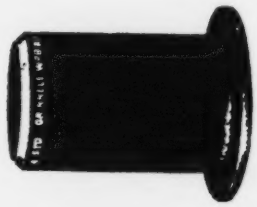
Step 1 **"O" Operation** - Select which operation is needed to find the answer (*addition, subtraction, multiplication, or division*).

Step 2 **"P" Pick** - Pick the numbers to work the operation.

Step 3 **"E" Execute** - Work the problem and find the answer.

Step 4 **"N" Note** - Does the answer seem correct?

1. The supervisor said the new flange should be 1.4375" longer than 7.6250". How long should the new flange be?



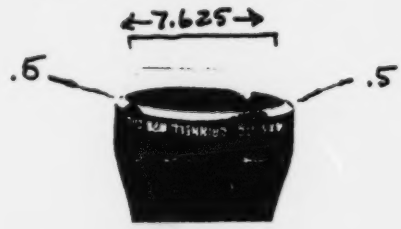
Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

2. The inside diameter of an 8" pipe (nominal pipe size) is 7.625. The wall thickness of the pipe is Sch. 80, or .500". If each side of the pipe wall is .500, what is the outside diameter of an 8" pipe? (Hint: Remember there are 2 sides to a pipe.)



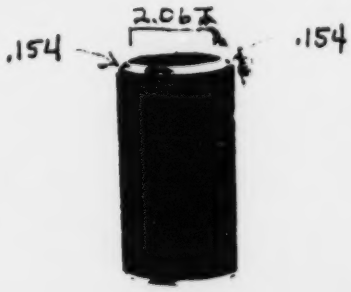
Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

3. What is the outside diameter of a nominal 2" pipe? The pipe's inside diameter is 2.067" and its two "Sch. 40" walls are .154" each or .308" together.



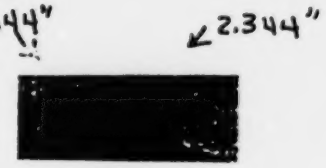
Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

4. Dow Chemical plans to install a special new pipe with an inside diameter of 19.312" and walls that are Sch 160 thick (each 2.344", or combined 4.688"). The new pipe's O.D (outside diameter) will be what?



Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

5. Andre's supervisor needs a concentric reducer that is 0.5625" longer than the one 4.8750" he has. How long should the reducer be?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

Concentric.

6. Bubba has a nominal 4" pipe that is 14.9375" long. He is told to make one that is 2.175" longer than the 14.9375" one. How long will the new pipe be?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

7. Jackie works for United Crafts. She was told to cut a 10.6250" pipe. What will be the total length of the pipe and welds at each end, if each of the welds is .3125"?

Step 1 **Operation:**

Step 2 **Pick:**

Step 3 **Execute:**

Step 4 **Note:**

Subtracting Decimals
Exercise 6 for Millwrights

Subtraction of Decimals

In the subtraction problems below you will subtract mixed numbers that include decimals. The first six problems include decimals that are given to the hundredths of an inch (two places to the right of the decimal point). As you work these problems you may wish to think of them as similar to money problems.*

Always place the decimal points in a line (above and below each other).

example: 5.68"
- 4.25"
1.43

NOT ~~5.68"~~
~~- 4.25"~~

1. Subtract 4.25" or $ 4.25
- 2.50" - 2.50

2. Subtract 3.00" or $ 3.00
- 1.25" - 1.25

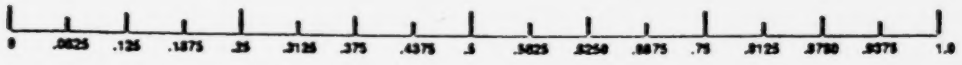
3. Subtract 11.50" or $ 11.50
- 3.25" - 3.25

4. Subtract 100.25" or $ 100.25
- 90.75" - 90.75

5. Subtract 145.25" or $ 145.75
- 26.25" - 26.25

* **Note**: If you'd like to use a calculator to work these problems, please do so.

These five subtraction problems include thousandths of an inch (three places to the right of the decimal point).



6. Subtract 12.375
-9.125

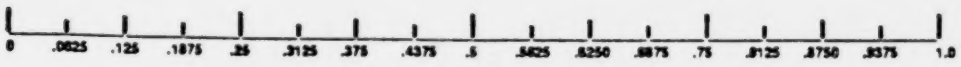
7. 14.875
- 4.625

8. 10.375
- 8.250

9. 74.175
- 53.625

10. 14.375
- 9.875

These five subtraction problems include ten thousandths of an inch (four places to the right of the decimal point).



11. Subtract 5.4375
-0.0625

12. 8.1875
-1.9375

13. 6.5625
-2.3125

14. 9.8125
-3.8125

15. 7.6875
-2.4375

The following problems are like what you may be asked to do on the job. It is important for you to think through how to find the answer. Use **"OPEN"**, the 4 step method:

Step 1 **"O" Operation** - Select which operation is needed to find the answer (*addition, subtraction, multiplication, or division*).

Step 2 **"P" Pick** - Pick the numbers to work the operation.

Step 3 **"E" Execute** - Work the problem and find the answer.

Step 4 **"N" Note** - Does the answer seem correct?

Let's work a word problem using the **"OPEN"** method:

Bubba has a pipe that is 14.9375". He is told to cut 2.1875 off the pipe. How long will it be then?

"OPEN" steps listed above:

Step 1 **Operation**: Subtraction

Step 2 **Pick**: The numbers are 14.9375" and 2.1875"

Step 3 **Execute**:
$$\begin{array}{r} 14.9375" \\ -2.1875" \\ \hline 12.7500" \end{array}$$

Step 4 **Note**: Does this answer seem correct? Yes

Use the **OPEN** steps to identify and work the following word problems:

16. Francis has a pipe that is 48" long. If she cuts a piece 32.555" off of it, how big will the piece be left?

Step 1 **Operation**:

Step 2 **Pick**: The numbers are:

Step 3 **Execute**:

Step 4 **Note**: Does it seem right?

17. Andre's supervisor said to take 0.5625" off the larger end of a concentric reducer that is 4.8750" long. How will the reducer be then?

Step 1 **Operation**:

Step 2 **Pick**: The numbers are:

Step 3 **Execute**:

Step 4 **Note**: Does it seem right?

18. Emily was asked to shorten a 45° elbow that was 6" long by 0.4375". What length should it be?

Step 1 **Operation**:

Step 2 **Pick**: The numbers are:

Step 3 **Execute**:

Step 4 **Note**: Does it seem right?

45° elbow

19. Shannon was told the 90° elbow with an outside arc of 12" was 0.3125" too long to connect two pipes. What length should it be?

Step 1 **Operation**:

Step 2 **Pick**: The numbers are:

Step 3 **Execute**:

Step 4 **Note**: Does it seem right?

90° elbow

20. In order to make a good weld, Jose was asked to cut 0.1875" off of an expander flange that is 3.4375" long. What length should it be?

Step 1 **Operation**:

Step 2 **Pick**: The numbers are:

Step 3 **Execute**:

Step 4 **Note**: Does it seem right?

Expander flange